IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	Venkat Selvamanickam, et al.		
Title:	SUPERCONDUCTOR FABRICATION PROCESSES		
App. No.:	10/816,045	Filed:	April 1, 2004
Examiner:	Brian K. Talbot	Group Art Unit:	1762
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MS AMENDMENT
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 C.F.R. §1.132

Sir, I hereby declare and state:

1. I am a joint inventor of the subject matter presently claimed in the above-identified patent application.

2. I received my doctorate degree in Materials Engineering from the University of Houston in Houston, TX.

3. I was employed by IGC/SuperPower, Inc. from 1994 to 2008, wherein I was mainly engaged in research and development of superconducting materials, superconducting conductors, and processes for forming same.

4. I have read the official action dated December 31, 2008 including the cited prior art. In particular, I have reviewed the cited prior art in detail, including US Pub 2004/0016401 Ignatiev et al. (hereinafter "Ignatiev"), R. Nemetschek et al., "Continuous Coated Conductor Fabrication by Evaporation" (hereinafter "Nemetschek"), JP 02-118075, JP 02-118061, Goyal et al., "Processing of High Temperature Superconductors" (hereinafter "Goyal"), US Pat 6,251,834 Glowacki et al. (hereinafter "Glowacki").

5. Background

The presently claimed invention is particularly drawn to a method of forming a superconductive device. The presently claimed invention particularly calls for annealing a metal alloy substrate after cleaning to relax the crystalline structure of the substrate tape. Additionally, the surface of the substrate remains randomly textured during annealing. Further, the claimed invention calls for depositing a biaxial texture buffer layer upon the polycrystalline and randomly textured substrate using ion beam assisted deposition. The depositing is carried out after annealing. We discovered the annealing step contributed to reduction in surface defects on the substrate tape, resulting in a high degree of texture of the buffer layer and a high quality superconductor layer. It is notable that the surface of the substrate remains polycrystalline and randomly textured throughout the process, rather than adopting a cubic texture during the annealing step.

It is known in the art that depositing a superconductor layer overtop a biaxially textured surface improves the current carrying capacity of the superconductor layer. Accordingly, multiple techniques have been developed to impart a high quality biaxial texture to the layers immediately beneath the superconductor layer. One such technique is the rolling assisted biaxially textured substrate (RABiTS) technique whereby a biaxial texture is induced in a metal substrate. Specifically, the metal substrate is deformed by rolling and subjected to specific annealing conditions to promote the formation of the biaxially textured crystal structure within the substrate. A buffer layer followed by a superconductor layer can be deposited overtop the RABiTS substrate. The buffer layer and the superconductor layer can be deposited in such a way so that they adopt the biaxially textured crystal structure of the substrate.

An alternative technique, Ion Beam Assisted Deposition (IBAD), has been developed to induce a biaxial texture within the buffer layer as it is deposited by bombarding the growing film with a ion beam at a specific incident angle. Preferably, the IBAD buffer layer is deposited on a substrate that is polycrystalline and randomly textured to avoid templating a structure that interferes with the biaxial texture induced by the IBAD technique.

6. Prior Art

Turning to the cited prior art, Ignatiev discloses a process for continuously depositing a superconductor layer onto a moving tape, including cleaning the tape followed by deposition of buffer layers and the superconductor layer. Similarly, Nemetschek discloses a continuous process for depositing buffer layers and a superconductor layer. Further, Nemetschek discloses electropolishing and cleaning the substrate prior to depositing the buffer layers and the superconductor layer. JP 02-118075 and JP 02-118061 both teach plasma cleaning a first superconductor layer prior to depositing a second superconductor layer. Goyal teaches applying a biaxially textured buffer layer on a polished metal substrate using IBAD. A superconductor layer is deposited over the biaxially textured buffer layer. As acknowledged by the USPTO, Ignatiev, Nemetschek, JP 02-118075, JP 02-118061, and Goyal fail to teach annealing the substrate.

Glowacki discloses a method depositing a superconductor layer overtop a textured substrate. A cubic α-phase is induced in the substrate using the RABiTS technique. Specifically, the metal tape is subjected to rolling and annealing to promote the formation of the cubic α-phase. The annealing step utilizes a two stage process wherein the substrate is first heated to 300°C to establish the cubic texture followed by heating the substrate to 700°C where grain growth takes place. See Glowacki at col. 2, lines 44-55. After the annealing step, the substrate is preferably cleaned by mechanical polishing and/or electropolishing to provide an ultra smooth surface for the deposition of the buffer and superconductor layers. The annealing step of Glowacki is specifically designed to induce and promote the formation of a highly ordered and crystalline texture within the substrate rather than relaxing the crystalline structure to maintain a polycrystalline and randomly textured surface.

7. Conclusion

Foremost, the annealing step described by Glowacki induces a cubic texture in the substrate and does not result in the major surface of the substrate remaining polycrystalline and randomly textured as claimed. Further, I, or another of skill in the art, would not combine the texture inducing annealing step of Glowacki with the IBAD buffer layer deposition of Goyal. During deposition of the buffer layer, the texture of the substrate and the ion beam would

compete to influence the texture of the buffer layer, diminishing the overall quality of the biaxial texture of the substrate and resulting in a poor quality superconductor layer.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like, so made, are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

May 5, 2009

Date

Venkat Selvamanickam